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"Welcome Shelter Near Trail's End"

★ FEDERAL-STATE COOPERATIVE
SNOW SURVEYS AND IRRIGATION WATER FORECASTS

for

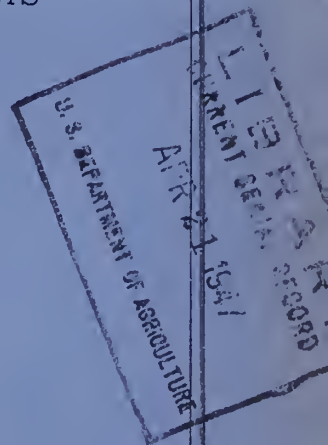
RIO GRANDE DRAINAGE BASIN

APRIL 1, 1947

By

Division of Irrigation, Soil Conservation Service
United States Department of Agriculture
and
Colorado Agricultural Experiment Station

Data included in this report were obtained by the agencies named above in cooperation with the U. S. Forest Service, National Park Service, State Engineers of Colorado and New Mexico and other Federal, State and local organizations.



April 1, 1947
WATER SUPPLY OUTLOOK
RIO GRANDE AND CANADIAN DRAINAGE BASINS

The outlook for water supply in irrigated areas served by the Rio Grande and its tributaries is generally poor. During February and March, the increase in snow cover in the mountain areas has been below average, but the water content of the snow is now 45 percent above last year. Soil moisture in the valley areas is very deficient. Reservoir storage is low. In the mountain areas, north of Santa Fe, on the headwaters of the Pecos River, the snow cover continues to be very light. On the tributaries to the Canadian River the water stored in snow is considerably above last year, but below normal.

RIO GRANDE

Snow cover during the month of March in the mountains surrounding the San Luis Valley has increased a negligible amount and has decreased at medium and lower elevations. Water stored in snow in this area is now about 75 percent of average and 60 percent above last year at this time. The extreme deficiency is on the headwaters of the Conejos River where the summer discharge is expected to be about 65 percent of normal. Conditions are best on the Culebra river in the eastern part of the valley where the summer runoff is expected to be near normal. Precipitation in the San Luis Valley has been very deficient the past three months and soil moisture is low. Stream flow is normal. Reservoir storage is very low and amounts to less than 45 percent of the past 10-year average on April 1.

Similar snow conditions exist over the headwaters of the Rio Chama and other Rio Grande tributaries in northern New Mexico. At Cumbres Pass the snow water content is only 60 percent of normal. Valley precipitation in the northern and middle Rio Grande areas has been very deficient and soil moisture and crop conditions are reported as unfavorable. Storage in El Vado reservoir is now 41,000 acre-feet or less than 45 percent of April 1, 1946.

The combined storage in Elephant Butte and Caballo reservoirs is down to 775,000 acre-feet as compared to 1,277,000 last year at this time. During the past month soil moisture and crop conditions have improved due to above normal rainfall in the lower Rio Grande area in southern New Mexico.

Snow cover on the headwaters of the Pecos River, Tesuque and Santa Fe Creeks continues to be very light. Precipitation at lower elevations is below normal. The irrigation water supply derived from snow for these and adjacent streams will be light. Storage at Alamogordo, McMillan and Avalon reservoirs is 10 percent less than last year on April 1st.

CANADIAN RIVER

On the tributaries to the Canadian River the water stored in the snow is 50 percent above last year but only 75 percent of normal. Storage in Conchas Reservoir on the Tucumcari project is now 365,000 acre-feet as compared to 341,000 a year ago. Stream flow and precipitation has been low. Range and crop conditions are only fair.

The first part of the paper discusses the importance of the study and the objectives of the research. It also mentions the scope of the study and the limitations. The second part of the paper discusses the methodology used in the study. It mentions the data sources and the data collection methods. The third part of the paper discusses the results of the study. It mentions the findings and the conclusions. The fourth part of the paper discusses the implications of the study. It mentions the practical applications and the future research. The fifth part of the paper discusses the conclusion of the study. It mentions the overall findings and the recommendations.

RIO GRANDE DRAINAGE BASIN

STREAM FLOW FORECASTS, April 1, 1947

Basin and Stream	April-September inclusive, Streamflow Thousands Acre Feet			
	Forecast 1947	Measured Runoff 1946	1945	10-year avg. 1936-1945
<u>RIO GRANDE</u>				
South Fork at South Fork	100,000		123,000	139,000
Rio Grande at Del Norte	425,000	347,000	467,000	555,000
Alamosa above Terrace Res.	60,000	50,000	77,000	81,000
Conejos at Mogote	150,000	124,600	221,000	233,000
Culebra at San Luis	35,000	16,000	39,000	39,000
Chama at Park View	170,000		267,000	262,000
Taos at Los Cordovas	60,000		42,000	48,000
Embudo Creek at Tixon	37,000		68,000	72,000
Rio Grande at Otowi Fridge	775,000		874,000	1,017,000
Pecos at Pecos	35,000		69,000	73,000

SNOW SURVEYS AND IRRIGATION WATER FORECASTS
RIO GRANDE BASIN

STATUS OF RESERVOIR STORAGE, APRIL 1, 1947

STREAM	RESERVOIR	USABLE CAPACITY 1000 A.F	THOUSANDS OF ACRE FEET IN STORAGE				10-year Ave. 1936-45
			About April 1				
			1947	1946	1945	1944	
RIO GRANDE	Rio Grande	45.8	6.9	6.4	21.4	9.8	18.6
	Santa Maria	45.0	5.5	7.5	11.8	5.6	10.1
	Sanchez	103.2	6.7	13.1	9.4	14.2	17.1
	Terrace	17.7	3.6	2.2	3.7	3.4	4.2
	Continental	26.7	1.2	7.6	17.7	7.8	6.3
	Elephant Butte	2273.7	512.3	1029.9	1223.9	1171.9	1138.9
	Caballo	365.0	262.8	247.9	281.0	259.3	165.2
CHAMA RIVER	El Vado	226.0	41.0	95.6	98.6	43.4	65.9
CANADIAN RIVER	Conchas	600.0	364.9	341.5	346.9	393.3	221.6
PECOS RIVER	Alamogordo	148.0	35.6	40.0	45.4	21.6	64.6
	McMillan-Avalon	45.1	4.7	5.0	6.5	25.5	25.4

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10

SNOW SURVEYS AND IRRIGATION WATER FORECASTS

for

RIO GRANDE BASIN

April 1, 1947

SUMMARY OF APRIL 1 SNOW SURVEYS AND COMPARISON OF DATA WITH THAT OF PREVIOUS YEARS BY WATERSHEDS

WATERSHEDS	Snow Depth		Water Content		Number Courses in		Snow Density		1947 Water Content in	
	Eleven Year Avg.*	1946	1947	Eleven Year Avg.*	1946	1947	Eleven Year Avg.*	1946	Eleven Year Avg.*	percent of
	In.	In.	In.	In.	In.	In.	Percent	Percent	Percent	1946
Rio Grande	28.3	13.4	20.1	9.4	4.1	6.7	33	31	71	163
South Fork	80.6	48.5	60.0	28.9	12.7	20.7	36	26	72	163
Upper Rio Grande	17.0	9.8	11.1	4.6	3.1	3.3	27	32	72	106
Alamosa River	42.7	27.5	35.0	12.6	6.8	10.7	29	25	85	158
Conejos River	45.9	22.4	28.6	16.2	6.2	9.7	35	28	60	156
Culebra River	34.3	16.8	35.8	10.5	4.4	10.8	31	26	103	246
Chama River	36.8	15.3	25.2	13.5	5.7	9.0	37	37	67	158
Rio Taos	18.6	8.5	17.7	6.7	3.2	9.0	36	38	134	282
Embudo Creek	27.9	17.9	20.7	8.8	6.0	6.3	32	34	72	105
Pecos River	11.6	4.9	2.0	3.7	1.5	0.6	32	31	16	40
Canadian River	24.1	10.4	18.3	7.7	4.1	5.5	32	39	72	134

*Some for shorter periods

PRECIPITATION DATA

WATERSHED	STATE	Precipitation		Departure from Normal		Precipitation*		Departure from Normal	
		October 1 to March 31	Inches	October 1 to March 31	Inches	March	Inches	March	Inches
Canadian	New Mexico		4.38		+0.36		0.45		-0.31
Rio Grande	Colorado		2.70		-0.78		0.19		-0.49
Rio Grande (N)	New Mexico		5.66		-0.82		0.59		-0.65
Rio Grande (S)	New Mexico		2.73		-1.03		0.27		-0.33
Pecos	New Mexico		4.61		+0.19		0.50		-0.25

Precipitation during March was below normal throughout the area. The accumulated precipitation since October 1 was below normal for all watersheds except the Pecos and Canadian.

*March precipitation tentative

RIO GRANDE DRAINAGE SNOW SURVEYS

April 1, 1947

DRAINAGE BASIN and SNOW COURSE	LOCATION				SNOW COVER MEASUREMENTS						Past Record Av. Water Content (Inches)	
	No. and State	Sec.	Twp. or Lat.	Range or Long.	Elev.	Date of Survey	Snow Depth (Inches)	Water Content (Inches)	1946	1945		Years of Record
							RIO GRANDE					
Wolf Creek Pass	26 Colo.	4	37N	2E	10000	3/31	60.0	20.7	12.7	33.4	12	28.9
Upper Rio Grande	27 "	13	40N	4W	9350	3/31	15.5	4.7	6.2	5.4	12	5.5
Silver Lakes	47 "	15	36N	5E	9600	4/2	13.3	3.2	1.4	7.9	11	5.5
River Springs	49 "	25	33N	6E	9300	4/1	15.6	4.2	1.6	10.2	11	6.9
LaVeta Pass #2	74 "	22	28S	70W	9300	4/1	25.2	8.2	4.9	11.4	12	7.8
Summitville	76 "	30	37N	4E	11500	3/31	56.6	18.2	12.2	21.3	9	19.8
Cumbres Pass #2	77 "	17	32N	5E	10000	3/31	41.5	15.2	10.7	29.4	12	25.6
Santa Maria	80 "	8	41N	2W	9700	4/1	6.7	2.0	0.0	3.4	9	3.7
Culebra	82 "		37.2N	105.2W	10000	4/1	35.8	10.8	4.4	12.7	8	10.5
Fort Garland	84 "	13	29N	72W	8200	4/1	0.0	0.0	0.0	3.7	8	3.0
Red River	1 N. Mex.	29	28N	15E	9500	3/31	19.9	6.3	1.3	16.0	11	8.7
Taos Canyon	2 "	10	25N	15E	9000	3/31	17.7	9.0	3.2	12.4	11	6.7
Aspen Grove	4 "	12	18N	10E	9100	3/31	2.6	0.7	1.4	7.3	11	3.5
Lee Ranch	5 "	3	18N	4E	9050	4/1	8.7	2.6	1.2	9.7	11	7.4
Canjilon	6 "	4	26N	6E	9500	3/29	47.9	20.1	12.1	26.5	11	22.6
Hamtite Park*	9 "	8	28N	15E	9500	4/1	13.3	3.9	0.3	10.8	11	5.4
Tres Ritos	12 "	23	22N	13E	9000	4/11	10.2	3.3	2.1	9.5	10	5.1
Pay Role	15 "	16	28N	7E	9700	3/28	22.1	5.4	3.5	11.2	8	8.7
Jicarilla	16 "	9	29N	1W	8500		0	0	0.0	2.3		
Chama Divide	17 "		36.9N	106.7W	7750	3/30	0.0	0.0	0.0	5.3	8	2.5
Chamita	18 "		36.9N	106.7W	8500	3/30	14.3	4.2	2.0	11.4	6	8.0
Cordova	19 "	22	22N	13E	10100	3/31	31.3	9.3	10.0	16.6	6	12.6
Panchuela #2	20 "	27	19N	12E	8300	4/1	1.0	0.3	0.0	3.0	11	2.0
Big Tesuque	21 "	17	18N	11E	10000	3/29	2.5	0.7	3.1	10.2	6	5.7
			Average for drainage				20.1	6.7	4.1	12.6		9.4

*On adjacent drainage

RIO GRANDE DRAINAGE SNOW SURVEYS

April 1 1947

DRAINAGE BASIN and SNOW COURSE		LOCATION				SNOW COVER MEASUREMENTS						
		No. and State	Sec. or Lat.	Range or Long.	Elev.	Date of Survey	Snow Depth (Inches)	Water Content (Inches)		Years of Record	Past Record Av. water content (Inches)	
RIO GRANDE TRIBUTARIES IN SAN LUIS VALLEY												
UPPER RIO GRANDE	27 Colo.	13	40N	4W	9350	3/31	15.5	4.7	6.2	5.4	12	5.5
Upper Rio Grande	80 "	8	41N	2W	9700	4/1	6.7	2.0	0.0	3.4	9	3.7
Santa Maria			Average for drainage				11.1	3.3	3.1	4.4		4.6
SOUTH FORK RIO GRANDE	26 Colo.	4	37N	2E	10000	3/31	60.0	20.7	12.7	33.4	12	28.9
Wold Creek Pass												
ALAMOSA RIVER	47 Colo.	15	36N	5E	9600	4/2	13.3	3.2	1.4	7.9	11	5.5
Silver Lakes	76 "	30	37N	4E	11500	3/31	56.6	18.2	12.2	21.3	9	19.8
Summitville			Average for drainage				35.0	10.7	6.8	14.6		12.6
CONEJOS RIVER	49 Colo.	25	33N	6E	9300	4/1	15.6	4.2	1.6	10.2	11	6.9
River Springs	77 "	17	32N	5E	10000	3/31	41.5	15.2	10.7	29.4	12	25.6
Cumbres Pass* #2			Average for drainage				28.6	9.7	6.2	19.8		16.2
CULEBRA RIVER	82 Colo.		37.2N	105.2W	10000	4/1	35.8	10.8	4.4	12.7	8	10.5
Culebra												
RIO GRANDE TRIBUTARIES IN NEW MEXICO												
CHAMA RIVER	77 Colo.	17	32N	5E	10000	3/31	41.5	15.2	10.7	29.4	12	25.6
Cumbres Pass #2	6 N.Mex.	4	26N	6E	9500	3/29	47.9	20.1	12.1	26.5	11	22.6
Canjilon	15 "	16	28N	7E	9700	3/28	22.1	5.4	3.5	11.2	8	8.7
Pay Role	16 "	9	29N	1W	8500		0	0	0.0	2.3		
Jicarilla	17 "		36.9N	106.1W	7750	3/30	0.0	0.0	0.0	5.3	8	2.5
Chama Divide	18 "		36.9N	106.7W	8500	3/30	14.3	4.2	2.0	11.4	6	8.0
Chamita			Average for drainage				25.2	9.0	5.1	16.8		13.5

*On adjacent drainage

*On adjacent drainage

April 1, 1947

*On adjacent drainage

The following organizations cooperate in the snow surveys and irrigation water supply forecasts for the Colorado, Missouri-Arkansas and Rio Grande watersheds by furnishing funds or services.

STATE

Colorado State Engineer
Wyoming State Engineer
Utah State Engineer
New Mexico State Engineer
Montana State Engineer
Nebraska State Engineer
Colorado Experiment Station
Colorado Extension Service
Montana Experiment Station
Utah Experiment Station

FEDERAL

Department of Agriculture
Forest Service
Soil Conservation Service
Department of Interior
Bureau of Reclamation
Indian Service
Geological Survey
National Park Service
Department of Commerce
Weather Bureau
War Department
Army Engineer Corps

PUBLIC UTILITIES

Colorado Public Service Company
Western Colorado Power Company
Montana Power Company
Denver and Rio Grande Western R. R. Company

MUNICIPALITIES

City of Bozeman
City of Denver
City of Boulder

WATER USERS ORGANIZATIONS

Poudre Valley Water Users' Association
Arkansas Valley Ditch Association
Colorado River Water Conservation District

IRRIGATION PROJECTS

Farmers Reservoir and Irrigation Company
San Luis Valley Irrigation District
Santa Maria Reservoir Company
Costilla Land Company
Uncompahgre Valley Water Users' Association
Wyoming Development Company
Goshen Irrigation District
Kendrick Project
Pathfinder Irrigation District
Salt River Valley Water Users' Association
San Carlos Irrigation and Drainage District
Twin Lakes Reservoir and Canal Company

Many other organizations and individuals furnish valuable information for the snow survey reports. Their cooperation is gratefully acknowledged.

